PROGRAM OF STUDIES: JUNIOR HIGH SCHOOL SCIENCE

PROGRAM OF STUDIES

JUNIOR HIGH SCHOOL SCIENCE

1977

INTERIM

PROGRAM OF STUDIES

SCIENCE

OBJECTIVES OF SECONDARY SCHOOL SCIENCE FOR ALBERTA

The learning of science as an area of human endeavour, should provide the student with a scientific literacy which enables him to assume an active and useful role as a citizen in a democratic society. It may be assumed that this literacy is best achieved by considering the individual needs of students and through independent study and learning.

The objectives of Secondary School Science are:

1. To promote an understanding of the role that science has had in the development of societies:

   a. history and philosophy of science as part of human history and philosophy

   b. interaction of science and technology

   c. effect of science on health, population growth and distribution, development of resources, communication and transportation, etc.

2. To promote an awareness of the humanistic implications of science:

   a. moral and ethical problems in the use and misuse of science

   b. science for leisure-time activities

3. To develop a critical understanding of those current social problems which have a significant scientific component in terms of their cause and/or their solution:

   a. depletion of natural resources

   b. pollution of water and air

   c. overpopulation

   d. improper use of chemicals

   e. science for the consumer

4. To promote understanding of and development of skill in the methods used by scientists:

   a. processes in scientific inquiry such as observing, hypothesizing, classifying, experimenting and interpreting data

b. intellectual abilities such as intuition, rational thinking, creativity, and critical thinking

c. skills such as manipulation of materials, communication, solving problems in groups, and leadership.

5. To promote assimilation of scientific knowledge:

a. emphasis on fundamental ideas

b. relevance of scientific knowledge through inclusion of practical applications

c. application of mathematics in science

d. interrelationships between the sciences

e. open-endedness of science and the tentativeness of scientific knowledge.

6. To develop attitudes, interests, values, appreciations, and adjustments similar to those exhibited by scientists at work.

7. To contribute to the development of vocational knowledge and skill:

a. science as a vocation

b. science as background to technical, professional and other vocations.

Grade Seven

Prescribed References:

Carter, J. L. et al, *Life Science: A Problem Solving Approach.* Scarborough: Ginn & Co., 1977

Smallwood, W. L., *Challenges to Science: Life Science.* Scarborough: McGraw-Hill, 1976

Objectives: After participating in the activities and completing the assignments associated with this course, the student

should be able to:

7.1 Demonstrate a knowledge of and be able to discuss the identified major concepts and their subconcepts within the context of a study of life science. These major concepts are:

7.1.1 All sets of objects including living things may be classified into groups having common characteristics.

7.1.2 Cells are the unit of structure and function of most living things.

7.1.3 Living things carry on certain fundamental processes to sustain and perpetuate life.

7.1.4 All living things interact with and are interdependent upon each other and their environment.

7.2 Acquire such investigative skills associated with science as:
-Observing with all the senses
-Classifying related objects or ideas
-Quantifying measured data
-Manipulating data to identify the patterns
-Identifying problems clearly so that the variables may be controlled or manipulated
-Interpreting data, making inferences leading to hypotheses and predicting future behaviour.

7.3 Identify and discuss the limitations of experimental data in terms of the underlying assumptions and the identified problem.

7.4 Assume a responsibility for keeping the workspace neat and tidy by practicing safe, and careful, work habits.

7.5 Recognize and be able to cite examples of the contributions made by such historical figures as Robert Hooke, Louis Pasteur.

7.6 Investigate factors related to the wise use of renewable resources and man's impact upon the environment.

CONCEPTS TO BE DEVELOPED

7.1 All sets of objects including living things may be classified into groups having common characteristics.	Subconcepts 1. Classification makes thinking about a large number of things simpler and easier. -Within large groups, members share some common characteristics; within smaller subgroups, members share a greater number of common characteristics. 2. An international system of classifying living things has been developed to facilitate the organization and exchange of knowledge of living things. -Living things may be classified as protist, plant or animal. 3. A simple key may be used to facilitate identification of organisms.
7.2 Cells are the unit of structure and function of most living things.	1. The techniques and tools of scientists aid in observing things (e.g. microscopes, balances, etc.) 2. Plant and animal cells share many common characteristics. 3. Cells live independently or in groups. a. Single celled organisms perform all the functions necessary for life. b. Some cells in multi-cellular organisms are specialized to carry out specific functions.
7.3 Living things carry on certain fundamental processes in order to sustain life.	1. Organisms require nutrients for energy. a. Green plants are the primary producers of food (photosynthesis). b. Digestion is the process of breaking down food. c. There is a chain of food and energy from primary producers to consumers to decomposers.

2. All living things obtain their energy from *respiration.*
   a. Respiration is the oxidation of sugar in controlled conditions.
   b. Organisms obtain oxygen from their environment in a variety of ways.

3. Food products and gases must be circulated to all cells throughout an organism (circulation).
   a. Cells receive nourishment and eliminate waste through the process of diffusion.
   b. More complex organisms show need for a more specialized circulatory system.

4. Organisms eliminate wastes to their environment (egestion and excretion).

5. *Growth* of an organism may result in change in structure or proportion, or an increase in size.

6. Living things react to their internal and external environment (sensitivity).
   a. Different species may have different ways of receiving and responding to stimuli.
   b. Living things differ in their response to the environment (adaptation).

7. To ensure survival of the species, living organisms must *reproduce.*
   a. Some organisms reproduce sexually, some asexually, and some by both means.
   b. An offspring inherits certain characteristics from its parents.
   c. There are many variations within a population.
   d. Living things have developed a variety of structural and behavioral adaptations to ensure reproduction.

7.4 All living things interact with and are interdependent with each other and their environment.

1. The biosphere is the region in which life on our planet is possible.

2. Eco-systems are units in the biosphere in which living and non-living things interact.

3. Plants and animals living and interacting in any eco-system are known as a community.

4. The members of each community show adaptations which are necessary for survival in the community.
   a. Some organisms are specific to certain communities (distribution).
   b. Some organisms may exist in more than one community (tolerance).

5. An organism is the product of both heredity and environment.

6. The environment and the distribution of organisms are in a state of continual change.
   a. Nature constantly re-cycles materials.
   b. Changes may take place over an extended period of time.

7. Man's influence on the environment can be directed constructively.
   a. Man's influence may increase the rate of change with beneficial or harmful results to the environment.
   b. Man commands the use of a great supply of energy to change the environment to his liking.
   c. Man's production and use of energy causes pollution.
   d. The preservation of man's biological resources depends on an awareness and the positive action of each individual.

Grade Eight

Prescribed References:

Heller, R. L. et al, *Challenges to Science: Earth Science.* Scarborough: McGraw-Hill, 1976

Jackson, J. H. and E. D. Evans, *Spaceship Earth: Earth Science.* Markham: Houghton-Mifflin, 1976

Objectives: After participating in the activities and completing the assignments associated with this course, the student should be able to:

8.1 Demonstrate a knowledge of and be able to discuss the identified major concepts and their associated subconcepts within the context of a study of the earth. These major concepts are:

8.1.1 A perspective of the position and motion of the Earth in space is gained by celestial observations and measurements.

8.1.2 Various theories attempt to explain the origin of the solar system and the universe.

8.1.3 Matter everywhere in the universe seems to be composed of the same elements that are found in the Earth.

8.1.4 The Sun is a typical star.

8.1.5 The surface of the Earth and its inhabitants are surrounded by an atmosphere of air.

8.1.6 Local conditions in the atmosphere are referred to as weather.

8.1.7 Weather conditions as recorded over a long period of time define the climate of a region.

8.1.8 Weather modification has occurred through man's activities.

8.1.9 Water is an important part of the Earth's surface.

8.1.10 The crust of the Earth is constantly being changed.

8.1.11 Evidence for determining the past history of the Earth comes from a study of the crust.

8.2 Demonstrate increasing competence in the investigative skills associated with science:
-Observing with all of the senses
-Manipulating technical instruments
-Collecting reliable data
-Manipulating the data to identify any patterns
-Interpreting data, making inferences leading to hypotheses, and predicting future behavior.

8.3 Participate in a study of some local phenomenon such as the weather patterns over a period of time, collect the data and relate these to the regional patterns and the long-term climatic conditions.

8.4 Recognize and be able to cite the contributions to modern theories of such scientists as Galileo, Kepler, Hutton and Wegener.

8.5 Examine topics of current scientific interest in an objective and open-minded manner.

CONCEPTS TO BE DEVELOPED

		Subconcepts
8.1	A perspective of the position and motion of the Earth in space is gained by celestial observation and measurements.	1. Through history man has searched for a systematic way of orienting himself and explaining his observations. 2. The motions of the Earth with respect to its neighbors have a profound effect on man. 3. The tools and technology used by Earth-Space scientists vary tremendously. -Earth-Space scientists use information from their observations to develop explanations of the universe.
8.2	Various theories attempt to explain the origin of the solar system and the universe.	1. Man's religions offer an explanation of the Earth's origins. 2. Science views the origins in terms of observable processes. a. Big Bang Theory is widely held as a possible explanation. b. Many others hold that the Steady-State Theory is more acceptable. c. Solar system origins can be explained in other ways.
8.3	Matter everywhere in the universe seems to be composed of the same elements that are found on the Earth.	1. Our knowledge of the universe comes from an analysis of its radiation. a. Spectroscopic studies of the radiation aid in giving knowledge about stars and planets. b. Radiation is studied with optical and radio telescopes. 2. Matter is clustered more densely in some parts of the universe. a. The largest local clusters of matter are galaxies. -galaxies are accumulations of many stellar bodies.

b. Stars and other celestial bodies can be classified and grouped.

3. Matter in the universe appears to be moving at tremendous velocities.
   a. Interstellar distances are measured in light years, and astronomical units.
   b. Observations of celestial positions are made over a period of many years to determine motions in the universe.

8.4 The Sun is a typical star.

1. Much of what we surmise about the stars comes from our observations of the Sun.
   a. Radiation from the Sun can be used to investigate its structure, motions, history and processes.
   b. Solar radiation is both beneficial and harmful to life on its planets.
   c. Solar gravity and planetary inertia maintain a system of planets in orbit.
      -Planetary motion is predictable.
      -The members of this solar system differ in their physical characteristics and dynamic properties:
      - several planets have satellites of their own,
      - the moon provides an opportunity to study an extra-terrestrial body;
      -Exploration of space has generated new knowledge, new technologies, and new problems.

2. Most of the Earth's energy comes from the Sun.
   -The radiation affects the atmosphere, the oceans and the land masses.

8.5 The surface of the Earth and its inhabitants are surrounded by an atmosphere of air.

1. Air is matter.
   a. Air is a mixture of gases.
   b. Air has weight and exerts pressure which can be measured.

2. The atmosphere is heated by the Sun's energy which is absorbed by the Earth.
   a. Radiant energy from the Sun is transformed into sensible and latent heat. Much of the incoming heat is absorbed by the Earth and its oceans.
   b. Heat absorption by the Earth varies.
      -Light colored areas reflect more heat than dark areas
      -Oceanic areas reflect more heat than continental areas
      -The altitude of the Sun above the

horizon affects the heat absorbed.
c. Absorbed heat is distributed by a number of mechanisms.
-Radiation is a means by which a warm body loses heat
-Convection currents distribute heat quickly and efficiently
-The distribution of heat is also achieved by conduction.

3. The air of the atmosphere is in constant motion due to unequal heating and the rotation of the Earth.
a. There is a pattern to the planetary winds with several clearly definable zones.
b. Local winds are affected by land forms and bodies of water.

4. Water vapor is an important constituent of air.
a. Water vapor enters the atmosphere by evaporation.
b. Water vapor eventually condenses as the air is cooled and becomes saturated
-Clouds and fog are condensed moisture suspended in the air
-Precipation is the result of moisture droplets becoming too large to remain in suspension.

8.6 Local conditions in the atmosphere are referred to as weather.

1. Weather reports give information about local and global atmospheric conditions.
a. The information is gathered by instruments at weather stations and by weather satellites.
b. The information given includes reports of air pressure, air temperature, relative humidity, wind direction and speed, cloud cover and precipitation.
c. The weather map is a record of the information gathered and is used to predict future weather.

2. An air mass is a large body of air with similar temperature and humidity at all levels.
a. Fronts form at the boundary between different air masses.
-Fronts can be classified
-Changes in weather are often associated with fronts
-Violent storms are often associated with fronts.
b. High pressure areas often serve to define

		the extent of air masses. c. Low pressure areas usually form in association with fronts.
8.7	Weather conditions as recorded over a long period of time define the climate of a region.	1. Weather statistics over a period of time can be used to compare one region with another. -Latitude, altitude, and position with respect to certain land forms and bodies of water determine the climate in a region. 2. Climate determines much of man's activities, housing, dress and diet.
8.8	Weather modification has occurred through man's activities.	1. Atmospheric pollution has become a major issue. 2. Rain-making and hail suppression are active research topics. 3. Fog and frost control has economic value.
8.9	Water is an important part of the Earth's surface.	1. The water cycle is the continuous movement of moisture from ocean to land and return. 2. The oceans form a large portion of the Earth's surface. a. Sea water contains many minerals in solution. b. There is a wide diversity of living organisms in the oceans. -The ocean's food supply may be very important to man's survival. c. The ocean floor has topography similar to that on the continents, with several important differences. -The continental margins are very important features both politically and economically. d. The circulation patterns of the ocean's water are the result of forces similar to those affecting the atmosphere. -Currents in ocean water are initiated by differences in density, salinity, and by the prevailing winds. -Movement of sea water tends to distribute heat. e. Wave action within bodies of water is an important force in the modification of the shore line. f. Tides are caused by the gravitational attraction between the Earth, Moon and Sun.

8.10 The crust of the Earth is constantly being changed.

1. Erosion is the process of wearing down of the land forms.
   a. Precipitation falls on the land areas and runs off to the sea.
      -Running water on the land surface tends to reduce the relief;
      -The rate of erosion depends upon the amount of run off, the gradient of the slope, the type of rock, and the ground cover;
      -Water run-off forms brooks, which form streams, which form river systems;
      -Sediments may be redeposited many times on their journey to the sea;
      -Soil is formed from the breakdown of the rock material;
      -Water that does not run off is held as ground water near the surface. In cold regions the ground water is held in perma-frost;
      -In cold climates precipitation builds up into glaciers; glaciers move under the influence of gravity and in doing so change the land surface. Surface features serve as evidence of past glaciation.
   b. Air movements carry materials from one place to another.
      -Windblown material is deposited in characteristic surface features.
      -Soil removal by winds may have serious economic effects.

2. Landforms are being built up by movements within the crust.
   a. Forces within the Earth cause deformation of surface features.
      -Earthquakes are the result of movements of masses of rock.
      -Volcanism is associated with faulting in the crust.
      -Faulting and folding are the result of large forces in the crust.
   b. Forces acting on the crust results from the nature of the structure of the Earth.
   C. Theories have been advanced to explain how forces have acted on the crust to produce the present landforms.
      -Continental drift, plate tectonics and sea floor spreading are theories advanced to explain crustal deformation.

8.11	The crust of the Earth is formed of rocks.	1. Rocks can be categorized into three main groups. a. Initially all rocks were formed by the cooling magma of the Earth. -Texture and mineral content of igneous rocks can be used for identification. b. Erosion and/or deposition form sedimentary rocks. -Grain size and/or mineral content of sedimentary rocks can be used for identification. c. Metamorphic rocks are reconstituted sedimentary and igneous rocks. -Metamorphic rocks are classified on the basis of their mineral content and structure. 2. Materials from the crust have had an important influence on the history of man. a. Man has mined the Earth for materials since prehistoric times. The mining of certain minerals is economically very important in Canada. b. Fossil fuels and their products are important in the economy of Alberta. c. Other rocks and minerals are of economic importance to Albertans. d. Crustal materials are limited and exploitation must be managed for maximum benefit.
8.12	Evidence for determining the past history of the Earth comes from a study of the crust.	1. Age determinations can be estimated on the basis of rates of changes of crustal materials. a. Sediments have been laid down throughout the life of the Earth. b. Radioactive elements decay at a measurable rate. 2. Fossil evidence can be used to relate past events in the history of the Earth from one place to another. a. There are different kinds of fossil evidence; remains, casts, molds, and replacement fossils. b. Fossil evidence is used in oil and gas exploration. 3. Earth history can be divided into periods of time on the basis of the type of fossil evidence. -Through geologic time life has become more complex and diversified.

Grade Nine

Prescribed References:

Bickel, C. L., et al, *Physical Science Investigations.* Markham: Houghton Mifflin, 1976.

Carter, J. L., et al, *Physical Science: A Problem Solving Approach.* Scarborough: Ginn and Co., 1977.

Heath, R. W. and R. R. McNaughton, *Physical Science: Interaction of Matter and Energy.* Toronto: D. C. Heath, 1976

Townsend, R. D. and P. DeH. Hurd, *Energy, Matter and Change.* Agincourt: Gage and Co. 1973

Objectives: After participating in the activities and completing the assignments associated with this course, the student should be able to:

9.1 Demonstrate a knowledge of and be able to discuss the identified major concepts and their associated subconcepts within the context of a study of physical science. These major concepts are:

9.1.1 Matter occupies space and has mass.

9.1.2 The forms and behavior of matter can be explained by the Kinetic molecular Theory.

9.1.3 The many forms of energy can be transferred from place to place or converted from one form to another, but in each case, the total amount of energy remains constant.

9.1.4 Matter and Energy are related and are interchangeable.

9.1.5 Energy is responsible for bringing about physical and/or chemical changes in the forms and behavior of matter.

9.2 Demonstrate proficiency in the scientific investigative skills of:
-Problem identification
-Outlining procedures and safe work habits
-Organizing observations and data
-Recording results
-Making inferences which relate to hypotheses
-Predicting future behaviors

9.3 Identify and discuss the development of a major scientific concept such as the kinetic molecular theory as it was explained by Galileo, Bacon, Thompson, Davy and Maxwell.

9.4 Participate in the routine management of the laboratory program by being responsible for the preparation of materials and equipment prior to and following laboratory periods.

9.5 Investigate scientific factors involved with a technological topic such as the development of alternative sources of energy.

CONCEPTS TO BE DEVELOPED

9.1 Matter occupies space and has mass.

Subconcepts

1. Fundamental to the process of science is the establishment of standards for making measurements.
   a. The development of standard units and systems of measurement has taken place slowly.
   b. Good measurement techniques are necessary in order to obtain meaningful data.
   c. All measurements are approximate.
   d. Relationships existing between measurement data are often more clearly defined and understanding clarified, by graphing techniques.

2. Matter can be measured by determining its linear dimensions, its surface area and its volume.
   a. Area is the number of square units of surface.
   b. Volume is the space occupied by matter.
   c. Volume of irregularly shaped solids may be found indirectly by liquid displacement.

3. Matter can be measured in terms of its mass and weight.
   a. Mass is a measure of the quantity of matter in an object.
   b. Weight of an object is a measure of the force of gravity acting on the object.

4. Density (average density) is a measure of the mass per unit volume of matter.
   a. Density is a characteristic property of any given sample of matter and is, therefore, useful for identification purposes.
   b. Molecular arrangement influences density.
   c. As the volume of a substance changes in response to temperature variation, the density changes.
   d. The influence of temperature change on density is generally less for a solid than for a liquid, and less for a liquid than for a gas.

5. Pressure is a measure of force acting on a unit area.
   a. Solids exert pressure on a surface.
   b. Fluid pressure varies directly with depth.
   c. At any point within a fluid, force and pressure are equal in all directions.
   d. Objects placed in fluids are subject to an upward buoyant force.
   e. In moving fluids, pressure decreases as velocity increases.

6. Inertia is a fundamental property of matter.
   -Matter has a natural tendency to continue in whatever state of motion or rest it is in, at any given instant.

9.2 The forms and behavior of matter can be explained by the Kinetic Molecular Theory

1. Matter is composed of tiny particles.
   a. A molecule is the smallest particle of matter that has the properties of a larger amount of that substance.
   b. Molecules vary in size.
   c. Spaces exist between the molecules of matter.
   d. Molecular composition determines the chemical properties of matter.
   e. Physical properties of matter are determined by inter-molecular distances and forces.

2. Molecules are in a state of constant motion.
   a. Brownian movement provides indirect evidence of molecular motion.
   b. Motion may be vibrational about a fixed position (solids).
   c. Molecules may be able to slide or move over one another in random directions (liquids).
   d. Molecules may have considerable freedom of movement in random directions (gases).

e. The greater the freedom and rate of movement of molecules of the same kind, the higher their energy content.

3. Heat and temperature are related.
   a. Heat refers to the total energy content of a substance due to molecular motion.
   b. Temperature is a measure of the average kinetic energy content of the molecules of a substance.
   c. Temperature may be measured indirectly by utilizing the response of matter to changes in temperature.
      -An arbitrarily chosen standard is necessary in the construction of most temperature scales.
      -Several temperature scales have been devised: - Celsius
      - Fahrenheit
      - Kelvin
   d. Heat is measured indirectly by the effects it produces.
      -Heat is measured by observing temperature changes of a known mass of water at a known initial temperature.
      -Heat is measured in joules.
   e. Different substances absorb or release different amounts of heat, even though they have similar masses and undergo similar temperature changes.
      -The heat capacity of water is greater than that of most other substances.
      -Substances having high heat capacities are good coolants.
   f. When a body at higher temperature is in contact with a body at a lower temperature, heat flows from the first to the second body.
      -Heat is conserved in that the amount of heat lost by one substance is equal to the amount of heat gained by the other.

4. Matter exists in different states.
   a. Matter can exist in solid, liquid or gas form.
      -Each state is characterized by definite general properties.
   b. The addition or removal of heat causes matter to change state.

c. As any given pure substance changes state, its properties change, its composition does not.
d. Temperature remains constant during a change of state.
e. The amount of heat required to change a given quantity of matter from solid to liquid, or from liquid to gas, is called latent heat of fusion and latent heat of vaporization, respectively.

5. A relationship exists between molecular motion and the volume occupied by matter.
   a. With few exceptions the volume of a solid increases as molecular vibrational motion increases.
   b. With the exception of water at temperatures below 4°C, liquids increase in volume as molecular motion increases.
   c. All gases, at constant pressure, expand uniformly as molecular motion increases.

6. Molecular movement is the basis for diffusion.
   a. Diffusion is the penetration of one type of molecule into matter consisting of a second type of molecule.
   b. Diffusion is slow in solids due to limited molecular motion and their closely packed orderly arrangement.
   c. Diffusion takes place more readily in liquids and gases.
   d. Rate of diffusion depends on the temperature of the substances.
   e. Rate of diffusion depends on the size of the molecules involved.
   f. Dissolving is a form of diffusion.
   g. Solutions are formed when molecules of one substance spread out evenly throughout another substance.
      -No boundaries between components of a solution can be observed.

7. Pressure in gases results from molecular motion.
   a. Gas pressure is due to molecular bombardment of a surface.
   b. Pressure depends upon the number of molecules present and their average speed.

c. Compression of gases results in increased molecular motion and thus increased temperature.
d. Expansion of gases results in reduced molecular motion and thus reduction of temperature.

8. Molecular motion results in evaporation.
   a. Evaporation involves a change in state from a liquid to a gas.
   b. Evaporation occurs as faster moving molecules near the surface escape.
   c. Evaporation produces a cooling effect.
   d. Different liquids evaporate at different rates.
   e. Rate of evaporation of a given liquid depends on:
      -Temperature of the liquid
      -Vapor content of the air above
      -Movement of air across the liquid surface
      -Surface area of the liquid that is in contact with the air.

9. Forces of attraction between molecules and characteristics of the molecules of a substance account for many properties of matter.
   a. Cohesion results from the forces of attraction existing between molecules of the same kind.
      -Cohesive forces are greatest in solids, weaker in liquids, and negligible in gases.
      -Tensile strength is a measure of cohesion between adjacent molecules.
      -Ductility, malleability and elasticity depend on cohesive forces.
      -Surface tension of liquids depends on cohesive forces.
   b. Adhesion is the force with which unlike molecules attract each other.
   c. Shape of liquid surfaces depends on cohesion and adhesion.
   d. Capillarity depends on both adhesion and surface tension.

9.3 The many forms of energy can be transferred from place to place or converted from one form to another, but in each case, the total amount of energy remains constant.

1. Energy is the ability or capacity to do work or cause motion.
   -Work encompasses factors of force, distance, movement and direction.
   -Work is accomplished only when the applied force causes an object to move in the same direction as the force.
   -Units of measurement have been devised which quantitatively express force, distance and work.
   -The rate at which work is done is defined as power.

2. Energy can be transferred from one place to another.
   a. Work represents a transfer of energy and/or heat.
   b. Machines transfer energy from place to place in order to do work advantageous to man.
      -Considering inclined planes, simple pulleys and pulley systems, and simple levers, machines are devices man uses to multiply force, to change the direction of a force, to gain speed, or to gain distance.
   c. The transfer and conversion of energy underlies conduction, convection, radiation.
   d. The transfer and conversion of energy underlies light, sound and electricity.

3. Energy may be described as either kinetic or potential energy.
   a. Energy is present in the universe in several forms:
      -electrical energy
      -chemical energy
      -mechanical energy
      -heat energy
      -light energy
      -nuclear energy
      -gravitational energy
      -magnetic energy
   b. One form of energy may be changed into another.

4. In all energy changes or transfers, the total amount of energy remains constant (Law of Conservation of Energy).

9.4 Matter and energy are related and interchangeable.

1. Theories and/or models have been developed to assist in understanding atoms.
   a. All matter is made up of atoms.
   b. The atomic model has an internal structure consisting of protons and neutrons forming a central core or nucleus, and an outer structure of electrons.
   c. The various kinds of atoms are called elements.

2. A relationship exists between atoms and molecules.
   -Atoms can exist individually or in combination with other atoms of the same or different elements, and therefore, are the building blocks of molecules.

3. A relationship exists among elements, compounds and mixtures.

4. Matter and energy are interrelated. The total amount of energy and matter in the universe remains constant.
   a. Matter is split apart to release energy in fission reactions.
   b. Matter is combined to release energy in fusion reactions.

9.5 Energy is responsible for bringing about physical and/or chemical changes in the forms and behavior of matter.

1. There is a difference between physical and chemical changes.
   a. In a physical change, one or more of the properties of a substance are altered but not its composition or identity.
      -A change of state represents one of the most common physical changes.
      -Changes in molecular motion and inter-molecular distances and forces of attraction account for physical changes.

b. In a chemical change, atoms are rearranged resulting in new substances with new properties.
   -Most chemical changes require a great deal more energy than do physical changes.
c. Some changes are reversible, some occur in cycles, some are irreversible.

2. There are several kinds of chemical changes or reactions.

3. Chemical reactions are usually accompanied by energy changes.

4. Rate of chemical reaction may be affected by temperature, concentration, surface area and catalysts.

DATE DUE SLIP

CURRICULUM GUIDE